about 5100 cu ft; about 30 per cent of this space will be occupied by tubes, etc., so that the net volume will be about 3570 cu ft, or a trifle over 100 cu m. A boiler of this size should operate on a coal consumption of about 2.5 Ib per horsepower with 20 per cent excess air. The gases of combustion will have the following volume:

	Volume of Waste Gases per Second			
	120 Per Cent Air Supply		140 Per Cent Air Supply	
	Cubic Feet	Cubic Meter	Cubic Feet	Cubic Meter
Normal rating	106	3.001	123	3.483
150 per cent of rating . .	159	4.501	185	5.225
200 per cent of rating . .	212	6.003	246	6.966
	318	9.005	369	10.449

The average temperature of the gases within the setting will be about 800° C., for which the value of the factor 1+0.003672 will be 3.936. This gives the average minimum and maximum gas volumes of 417 and 1455 cu ft, from which the average time of the gas inside the setting will be 8.56 seconds for the minimum amount of gas and 2.46 seconds for the maximum amount of gas. This gives a temperature drop of from 117° to 407° C. per second.

The distance from the grate to the smoke-flue outlet is about 60 ft, which gives an apparent average velocity of flow ranging from 7 to 24.5 ft per second.

Assuming that the combustion arch is about 6 ft above the grate and the gases leave the

fuel at a temperature of 1400° C., they will have an upward pressure against the arch slightly less than 0.10 in of water, and their velocity will be about 42 ft per second. At 200 per cent of rating the volume of gases rising from the fuel bed will be about 212 cu ft per second, which at 1400° C. will give a volume of 1300 cu ft. The firebox of the boiler has a width of 15 ft and the arch will be about 12 ft deep from the front wall, giving an area of 180 sq ft. From Bazin's formula for the flow of water over weirs, Professor Yesmann, of the Polytechnic Institute of Petrograd, has developed a formula which makes it possible to approximate the depth to which the space below this arch will be occupied by the hot gases. In reaching this arch,